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Jianglei Ma

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CANADA

EXAMINER

GREY, CHRISTOPHER P

ART UNIT

PAPER NUMBER

2474

NOTIFICATION DATE

DELIVERY MODE

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ELECTRONIC

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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|                              |  |                                  |  |
|------------------------------|--|----------------------------------|--|
| <b>Office Action Summary</b> | <b>Application No.</b><br>10/593,053   | <b>Applicant(s)</b><br>MA ET AL. |  |
|                              | <b>Examiner</b><br>CHRISTOPHER P. GREY | <b>Art Unit</b><br>2474          |  |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 15 September 2006.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1,2,4,5,20,24-26,46,47 and 53-73 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1,2,4,5,20,24-26,46,47 and 53-73 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)            | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)   | Paper No(s)/Mail Date. _____                                      |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____  | 6) <input type="checkbox"/> Other: _____                          |

## **DETAILED ACTION**

### ***Election/Restrictions***

1. Claims withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected Group II and III, there being no allowable generic or linking claim. Election was made **without** traverse in the reply filed on 11/18/10.

### ***Claim Rejections - 35 USC § 112***

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:  
  
The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.
3. Claims 1, 2, 4, 5, , 20, 24, 25, 26, 46, 47, 53-73 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.
4. Claim 1 recites the limitation "the four antennas" in line 5. It is unclear whether or not "the four antennas" is related to the preceding mention of "four transmit antennas.

### ***Claim Rejections - 35 USC § 102***

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

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6. Claims 1, 2, 4, 5, 20, 24-26, 46, 53-57, 59-61, and 69-72 are rejected under 35 U.S.C. 102(e) as being anticipated by Ma et al. (US 2003/0072254), hereinafter referred to as Ma.

**Regarding claim 1,** Ma teaches a method of transmitting over four transmit antennas **(Para 0045 shows number of antennas,  $N \geq 2$ )** comprising:

for each antenna, generating a respective sequence of OFDM symbols, each OFDM symbol having a plurality of sub-carriers carrying data or pilots, and transmitting the sequence of OFDM symbols **(Para 0060-0061 shows OFDM symbols being transmitted through transmitter's antenna's);**

wherein pilots are inserted for the four antennas collectively in blocks of two sub-carriers by two OFDM symbols scattered in time and frequency **(See figure 5 and related description which shows that pilots are inserted as such, i.e. Para 0023 shows scattering).**

**Regarding claim 2,** Ma teaches wherein pilots are inserted for the four antennas collectively in blocks of two sub-carriers by two OFDM symbols scattered in time and frequency by:

inserting such blocks of two sub-carriers by two OFDM symbols scattered in a first regularly spaced pattern in even pairs of OFDM symbols **(Figure 5, notice in the time axis, symbols are inserted by an even number);**

inserting such blocks of two sub-carriers by two OFDM symbols scattered in a second regularly spaced pattern offset from said first regularly spaced pattern in odd pairs of OFDM symbols **(Figure 5, notice in the frequency axis, symbols are**

**inserted by an odd number).**

**Regarding claim 4,** Ma teaches wherein each block of two sub-carriers by two OFDM symbols comprises a single pilot for each of the four antennas in a respective position within the block (Para 0075, describes figure 5).

**Regarding claim 5,** Ma teaches wherein the single pilot for each of the four antennas takes the same position in every block of two sub-carriers by two OFDM symbols **(where Para's 0080-0082 shows that the pilots on different antennas are recovered from the same positions in the time-frequency block).**

**Regarding claim 20,** Ma discloses using different pilot patterns for respective four antenna transmitters to reduce interference between pilots of different four antenna transmitters **(Para 0073, shows different pilot patterns being utilized).**

**Regarding claim 24,** Ma discloses transmitting at least one fixed pilot for each of at least one of the four antennas **(Para 0045 shows 4 antennas and Figure 2, 23 shows fixed pilots such as P1 and P2).**

**Regarding claim 25,** Ma discloses comprising transmitting at least one fixed pilot for each of two pairs of antennas within said four antennas **(Para 0045 shows 4 antennas and Figure 2, 23 shows fixed pilots such as P1 and P2).**

**Regarding claim 26,** Ma discloses transmitting at least one fixed signalling channel for each of two pairs of antennas within said four antennas **(Para 0045 shows 4 antennas and Figure 2, 23 shows fixed pilots such as P1 and P2 and figure 5, which show signaling pilots on channels).**

**Regarding claim 46,** Ma discloses a transmitter comprising four transmit antennas, the

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transmitter being adapted to implement the method of claim 1 (**Figure 2 shows OFDM transmitter and Para 0045 shows 4 antennas**).

**Regarding claim 53,** Ma discloses wherein the first regularly spaced pattern comprises a repeating pattern of two pilot sub- carriers, ten data sub-carriers and the second regularly spaced pattern comprises six data sub-carriers followed by a repeating pattern of two pilot sub-carriers and ten data sub-carriers (**See figure 3, notice ten data subcarriers between pair of pilots in the frequency direction, and 6 data sub-carriers between the pair of pilots in the time axis**).

**Regarding claim 54,** Ma discloses wherein each block of two sub- carriers by two OFDM symbols is divided into pilot pairs (**Figure 5, notice pilot pairs**), each pilot pair being transmitted by a respective pair of antennas (**Para 0075 shows pilots being transmitted through respective antenna**).

**Regarding claim 55,** Ma discloses wherein each pilot pairs is arranged sequentially in time (Figure 5, notice time axis, and sequences of pilot pairs).

**Regarding claim 56,** Ma discloses wherein each pilot pair is arranged sequentially in frequency (**Figure 5, notice frequency axis**).

**Regarding claim 57,** Ma discloses wherein pilots are inserted for the four antennas collectively in blocks of two sub-carriers by two OFDM symbols scattered in time and frequency in a repeating pattern of six OFDM symbols comprising each comprising a first, second and third pair of OFDM symbols, the method comprising:

inserting such blocks of two sub-carriers by two OFDM symbols scattered in a first regularly spaced pattern in each first pair of OFDM symbols;

inserting such blocks of two sub-carriers by two OFDM symbols scattered in a second regularly spaced pattern offset from said first regularly spaced pattern in each second pair of OFDM symbols; and

inserting such blocks of two sub-carriers by two OFDM symbols scattered in a third regularly spaced pattern offset from said second regularly spaced pattern in each third pair of OFDM symbols are inserted for the four antennas collectively in blocks of two sub-carriers by two OFDM symbols scattered in time and frequency in a repeating pattern of OFDM symbols that is a multiple of two OFDM symbols in length **(Figure 5, notice frequency axis, and 3 pairs of pilots, and the time axis shows the repeating sequence).**

**Regarding claim 59,** Ma discloses transmitting pilots with a power higher than average power **(Para 0028, power is greater).**

**Regarding claim 60,** Ma discloses wherein data and pilots are transmitted using QPSK, with the pilots being transmitted with a relative power boost **(Para 0060 shows QPSK and Para 0029 shows power adjustment).**

**Regarding claim 61,** Ma discloses wherein data is transmitted using a QAM constellation, and pilots are transmitted using QPSK with signal constellation points at corners of the QAM constellation **(Para 0060 shows QAM and QPSK).**

Regarding claim 62, Ma discloses transmitting relatively reliable signalling channel information proximal in time and frequency to locations of pilots (Para 0062-0064).

Regarding claim 63, Ma discloses wherein transmitting relatively reliable signalling channel information proximal in time and frequency to locations of pilots comprises:

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for pairs of antennas of the four antennas, transmitting space time coded signalling channel information pairs adjacent in time to pairs of pilots (Para 0062-0064).

**Regarding claim 69,** Ma discloses wherein the pilots are space-time coded (Para 0061 STBC).

**Regarding claim 70,** Ma discloses wherein the pilots are space-frequency coded (Para 0061 STBC).

**Regarding claim 71,** Ma discloses wherein the pilots are space-time-frequency coded (Para 0061 STBC).

**Regarding claim 72,** Ma discloses wherein the pilots are uncoded (Figure 2 shows the pilots before they are encoded in element 23).

### ***Claim Rejections - 35 USC § 103***

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

8. Claims 47, 64, 66-68, 73 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ma et al. (US 2003/0072254) in view of Ma et al. (US 2003/0072255), hereinafter referred to as Ma2.

**Regarding claim 47,** Ma discloses implementing the method of claim 1 (as described above).



Ma does not specifically disclose at least two base station transceivers collectively comprising four transmit antennas, the at least two base station transceivers adapted to implement the method of claim 1.

Ma2 discloses at least two base station transceivers collectively comprising four transmit antennas, the at least two base station transceivers adapted to implement the method of claim 1 (Para 0005 shows wireless communication systems having multiple BTS's).

It would have been obvious to one of the ordinary skill in the art at the time of the invention was disclosed to modify the communication of Ma, since stated in the background of Ma2 that it is common in the art for a MIMO-OFDM system to employ multiple base stations.

**Regarding claim 64,** Ma does not specifically disclose wherein for a given, antenna, a spacing between pilots in the time direction is determined with consideration to the maximum Doppler frequency, while a spacing between pilot in the frequency direction is determined with consideration to a delay spread of multi-path fading.

Ma2 discloses wherein for a given, antenna, a spacing between pilots in the time direction is determined with consideration to the maximum Doppler frequency, while a spacing between pilot in the frequency direction is determined with consideration to a delay spread of multi-path fading (Paragraph 0109, shows max Doppler and max channel delay).

It would have been obvious to one of the ordinary skill in the art at the time of the invention was disclosed to modify the communication of Ma, since stated in the

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background of Ma2 that it is common in the art for a MIMO-OFDM system to employ multiple base stations.

**Regarding claim 66,** Ma does not specifically disclose wherein the four transmit antennas form part of a single base station transceiver.

Ma2 discloses wherein the four transmit antennas form part of a single base station transceiver (Para 0005 shows wireless communication systems having multiple BTS's).

It would have been obvious to one of the ordinary skill in the art at the time of the invention was disclosed to modify the communication of Ma, since stated in the background of Ma2 that it is common in the art for a MIMO-OFDM system to employ multiple base stations.

**Regarding claim 67,** Ma does not specifically disclose wherein the four transmit antennas form part of multiple base station transceivers.

Ma2 discloses wherein the four transmit antennas form part of multiple base station transceivers (Para 0005 shows wireless communication systems having multiple BTS's).

It would have been obvious to one of the ordinary skill in the art at the time of the invention was disclosed to modify the communication of Ma, since stated in the background of Ma2 that it is common in the art for a MIMO-OFDM system to employ multiple base stations.

**Regarding claim 68,** Ma does not specifically disclose wherein the four transmit antennas form part of multiple mobile stations.

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Ma2 discloses wherein the four transmit antennas form part of multiple mobile stations (Para 0004-0006 shows wireless communication systems having multiple BTS's and users/mobiles).

It would have been obvious to one of the ordinary skill in the art at the time of the invention was disclosed to modify the communication of Ma, since stated in the background of Ma2 that it is common in the art for a MIMO-OFDM system to employ multiple base stations.

**Regarding claim 73,** Ma does not specifically disclose at least two mobile stations collectively comprising four transmit antennas, the at least two mobile stations adapted to implement the method of claim 1.

Ma2 discloses at least two mobile stations collectively comprising four transmit antennas, the at least two mobile stations adapted to implement the method of claim 1 (Para 0004-0006 shows wireless communication systems having multiple BTS's and users/mobiles).

It would have been obvious to one of the ordinary skill in the art at the time of the invention was disclosed to modify the communication of Ma, since stated in the background of Ma2 that it is common in the art for a MIMO-OFDM system to employ multiple base stations.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to CHRISTOPHER P. GREY whose telephone number is (571)272-3160. The examiner can normally be reached on 10AM-7:30PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Moe Aung can be reached on (571)272-7314. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Christopher P Grey/  
Examiner, Art Unit 2474